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IS 12791 : 1989

(Reaffirmed 2002)

Indian Standard

HIGH CARBON-CHROMIUM BEARING STEEL TUBES FOR THE MANUFACTURE OF BEARING RACES — SPECIFICATION

भारतीय मानक

बेयरिंग रेशों के निर्माण के लिए उच्च कार्बन-क्रोमियम बेयरिंग इस्पात नलियाँ – विशिष्टि

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1990

Price Group 3

Steel Tubes, Pipes and Fittings Sectional Committee, MTD 19

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 1 November 1989, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard has been prepared to meet the growing needs of the industry for specifying the requirements for high carbon-chromium (bearing) steel tubes, used, in the manufacture of ball and roller bearings.

Parameters such as machineability, residual stresses residual magnetism and surface hardness limits were discussed and it was noticed that these are not specified in any overseas specifications on this subject. However, data can be collected on these parameters by both the bearing manufacturers and bearing tube manufacturers within the country and possibility of its incorporation in the standard can be considered only after sufficient data is available on the subject.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HIGH CARBON-CHROMIUM BEARING STEEL TUBES FOR THE MANUFACTURE OF BEARING RACES – SPECIFICATION

1 SCOPE

1.1 This standard covers the requirements for high carbon-chromium bearing steel tubes to be used in the manufacture of ball and roller bearings.

2 REFERENCES

2.1 The Indian standards listed below are necessary adjuncts to this standard.

IS No.	*Title*
IS 228 (in various parts)	Methods for chemical analysis of steel
IS 1387 : 1967	General requirements for the supply of metallurgical materials (*first revision*)
IS 4163 : 1982	Methods for determination of inclusion content in steel by microscopic method (*first revision*)
IS 4398 : 1972	Carbon-chromium steel for the manufacture of balls, rollers and bearing races (*first revision*)
IS 6396 : 1983	Methods of measuring decarburized depth of steel (*first revision*)

3 SUPPLY FOR MATERIAL

3.1 General requirements relating to the supply of material shall conform to IS 1387 : 1967.

3.2 The tubes shall be supplied in bundles of weight up to 1 000 kg However. if smaller or larger bundles are required, it shall be as per agreement between the purchaser and the manufacturer. The tubes shall be suitably oiled for rust protection on both the outside and inside. The ends of the tubes shall be square cut or deburred or chemfered as required. Each bundle shall be identified with a metal tag mentioning the manufacturer's name or trade mark, tube size, bundle number and bundle weight. The tubes shall be supplied in length 3 to 4·5 metres and they shall be straight within 1 in 1 000 over the full tube length. 10 percent of the tubes may be in shorter lengths not less than 2 metres.

4 MANUFACTURE

4.1 Steel used for the manufacture of tubes shall conform to IS 4398 : 1972. Vacuum degassing shall be carried out if required to maintain the cleanliness rating. The tubes shall be supplied either in hot worked and spheroidised condition or in spheroidized annealed condition and cold worked condition. The tubes in any other condition may also be supplied as per mutual agreement between the purchaser and the manufacturer.

5 MATERIAL

5.1 The starting material for the manufacture of tubes as per this specification shall be either forged or rolled round, square or gothic section and shall conform to the following quality requirements.

5.1.1 *Macroetch Test*

One sample disc shall be cut from that end of the rolled/forged round which represents the top and bottom of each ingot. The sample when macroetched (with 1 : 1 Hydrochloric acid) at a temperature of 70 to 80°C should show freedom from piping, segregation and any other harmful defect.

5.1.2 The inclusion rating shall be determined in accordance with IS 4163 : 1982. Two-thirds of all specimens and at least one from each ingot tested, as well as the average of all specimens, shall not exceed the rating specified in Table 1. If required, lower limits for inclusion rating may be agreed to between the purchaser and the manufacturer.

5.1.3 Test specimen, approximately 10 mm in thickness representative of the cross section of billets for forging, rolling into tubes shall be normalised, annealed and hardened by quenching in oil from a temperature of 830 ± 5°C and fractured. The fractured surfaces when examined visually shall be free from any of the following defects:

a) Presence of more than one non-metallic inclusion of 1·6 to 3 mm in length,

b) Presence of non-metallic inclusions over 3 mm in length, and

c) Presence of porosity, pipe or internal cracks.

5.1.4 The fracture shall show fine grains.

Table 1 Inclusion Rating

(*Clause* 5.1.2)

	Thin Series	Thick Series
A (Sulphides)	2·5	1·5
B (Alumina)	2·0	1·5
C (Silicates)	2·0	1·5
D (Golbular oxides)	1·5	1·5

6 CHEMICAL COMPOSITION AND ANALYSIS

6.1 The ladle analysis of the steel of the tubes shall conform to the requirements as specified in Table 2.

Table 2 Chemical Composition

(*Clauses* 6.1, 6.1.1 *and* 6.2)

Element	Composition, Percent
Carbon	0·98 - 1·10
Chromium	1·30 - 1·60
Manganese	0·25 - 0·45
Silicon	0·15 - 0·35
Phosphorus, *Max*	0·025
Sulphur, *Max*	0·025
Nickel, *Max*	0·25
Copper, *Max*	0·25
Molybdenum, *Max*	0·10
Vanadium, *Max*	0·05

NOTE — The purchaser may specify requirements, if any, for elements such as titanium, aluminium, oxygen etc.

6.1.1 The ladle analysis of steel shall be as given in Table 2. The analysis of steel shall be carried out either by the method specified in IS 228 and its relevant parts or any other established instrumental/chemical method. In case of dispute the procedure given in IS 228 and its relevant parts shall be referee method. However, where the method is not given in IS : 228 and its relevant parts, the referce method shall be agreed to between the purchaser and the manufacturer.

6.2 Product Analysis

Product analysis shall be carried out on finished tube. The permissible variation in the case of product analysis from the composition specified in Table 2 shall be as given in Table 3.

Table 3 Permissible Variation for Product Analysis

(*Clause* 6.2)

Constituent	Permissible Variation, Plus or Minus, Percent
Carbon	0·03
Manganese	0·03
Silicon	0·02
Sulphur	0·005
Phosphorus	0·005
Chromium	0·05
Nickel	0·03
Copper	0·03
Molybdenum	0·01
Vanadium	0·01

7 CONDITION OF DELIVERY

7.1 The tubes shall be either hot finished or cold finished. The tubes shall be supplied with a fully spheroidized structure.

8 SURFACE CONDITION

8.1 The surface of hot worked tube shall be reasonably good without any injurious defects like cracks, laps, etc. and give defect-free surface on finish machining. Cold worked tubes shall have smooth surface. The depth of decarburisation shall be as per Table 4 and machined rings shall be free of decarburization and surface defects.

8.2 The method of measuring the depth of decarburization shall be generally microscopic method or as per IS 6396 : 1983.

Table 4 Decarburization and Surface Defects for Tubes

(*Clause* 8.1)

Size mm	Decarburization and Surface Defects per Side Maximum, mm	
	Annealed Tubes	Cold Finished Tubes
0-up to and including 25·4	0·31	0·21
25·4 up to and including 50·8	0·51	0·36
50·8 up to and including 76·2	0·76	0·48
76·2 up to and including 101·6	0·89	0·61
101·6 up to and including 127·0	1·02	0·71

9 HEAT TREATMENT

9.1 All tubes shall be annealed and the annealed material shall show a completely spheroidised structure of uniformly distributed small globular carbides (*see* Fig. 1). The acceptable spheroidized structure shall be as given for Grades 2, 3 and 4 in Fig. 1.

9.1.1 The structure shall be free from excessive segregation and shall not reveal presence of carbides in cellular form (*see* Fig 2). The acceptable limits for carbide banding shall be as for Grades 1 and 2 given in Fig. 2.

10 HARDNESS

10.1 Hot worked tube shall be supplied in spheroidized annealed condition having maximum hardness of 207 BHN at any point of length. Cold worked tubes shall have hardness of 320 BHN maximum at any point of length. Cold worked and stress relieved tubes shall have hardness of 250 BHN maximum.

11 DIMENSIONS AND TOLERANCES

11.1 Dimensions

Nominal dimensions for outside diameter and wall thickness of the tubes shall be as per the agreement between the purchaser and the manufacturer.

11.2 Tolerances

Tolerance on outside diameter (OD) and wall thickness shall be as given in Table 5.

12 TEST CERTIFICATES

12.1 Upon request of the purchaser in the contract or order a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished. Test certificate for each supply should be supplied.

Table 5 Tolerances

(*Clause* 11.2)

	Size		Dimensional Tolerances	
	Over	To	Hot Worked	Cold Worked
i) Outer Dimension				
	—	Up to 75 mm	± 0·40 mm	—
	75 mm	100 mm	± 0·50 mm	—
	100 mm	125 mm	± 0·60 mm	—
	125 mm	180 mm	± 0·90 mm	—
	20 mm	60 mm	—	+ 0·3 mm — 0·0 mm
	60 mm	127 mm	—	+ 0·4 mm — 0·0 mm
ii) Wall thickness				
	—	Up to 5·1 mm	± 6 percent	± 6 percent
	5·1	7·1 mm	± 5 percent	± 5 percent
	7·1	8·0 mm		
	8·0	10·2 mm		
	10·2 and above			

NOTES

a) However, deviations in dimensional tolerances both in respect of outside diameter and wall thickness due to process limitations may be mutually agreed upon between the manufacturer and the purchaser.

b) Ovality in any type of tubes shall be half of the outside diameter tolerance.

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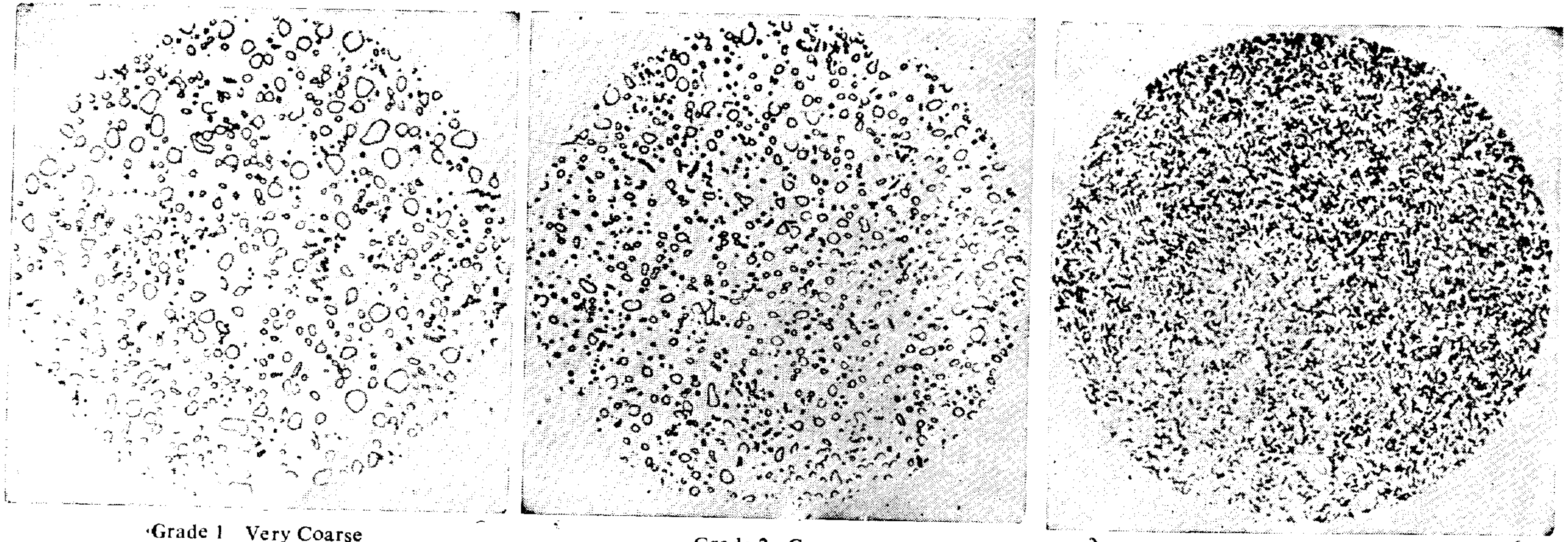
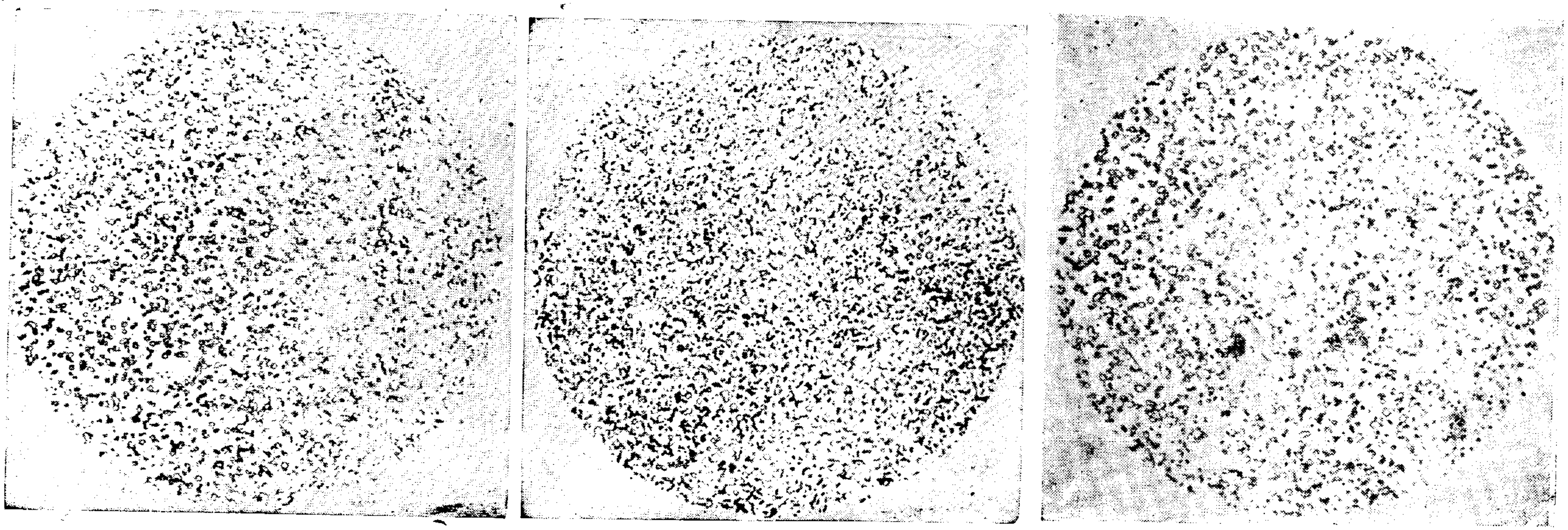


Grade 1 Very Coarse

Grade 2 Coarse

Grade 3 Fine

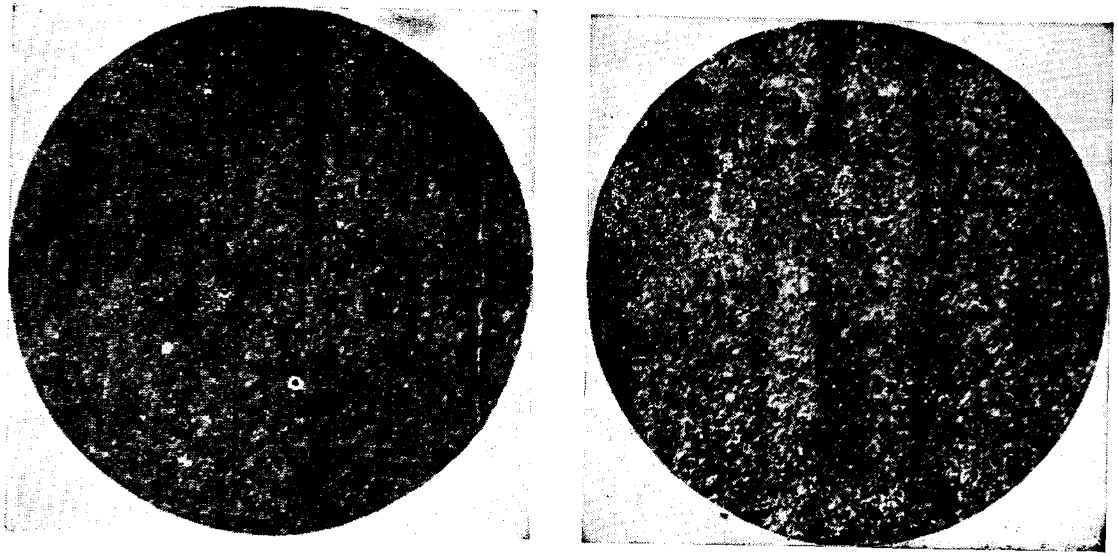


Grade 4 Fine

Grade 5 Very Fine

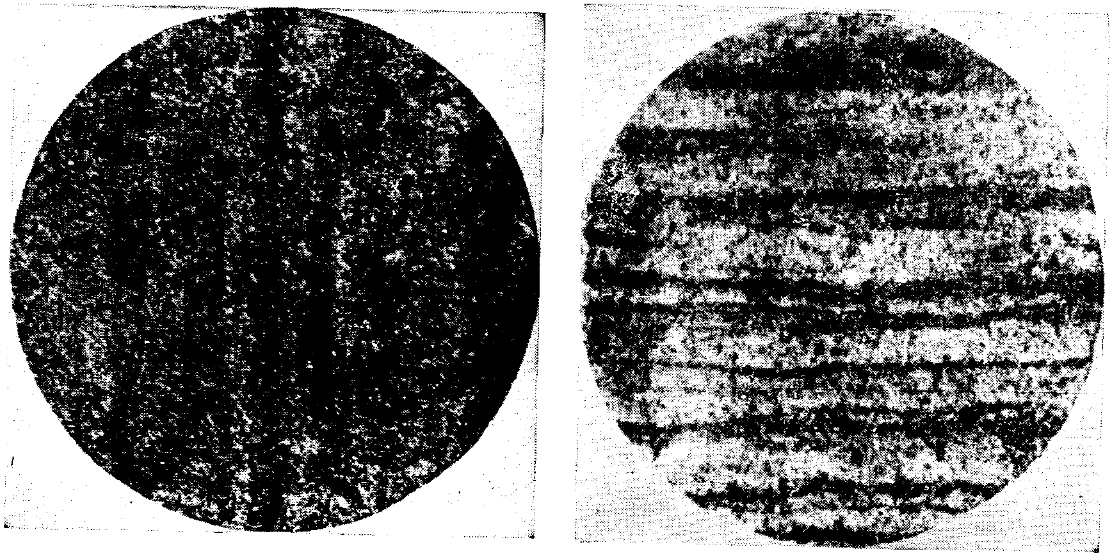
Grade 6 Extremely Fine

FIG. 1 SPHEROIDIZED ANNEALED STRUCTURE (Magnification 1 000×)



Grade 1

Grade 2



Grade 3

Grade 4

FIG. 2 CARBIDE BANDING (Magnification 100×)

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